Limited Visual Dam Safety Inspection Summary Report

MA-144

Maui County Water

Maui, Hawaii

Prepared by:

U.S. ARMY CORPS OF ENGINEERS
HONOLULU ENGINEER DISTRICT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

May 2006

Dam ID: MA-0144
Name: Maui County Water

Limited Visual Dam Safety Inspection Conducted on: 07 April 2006

I. Purpose

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections are authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statues, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections are being conducted under joint agreements of the U.S. Army Corps of Engineers (USACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection will be made on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works would include the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may appear to be no immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

V. Inspection Team

Organization	Name /Title
U.S. Army Corps of Engineers	Henri Mulder, P.E. Civil Engineer
U.S. Army Corps of Engineers	John Dillon Geotechnical Engineer
USDA, Natural Resource Conservation Service	Diana Perry
State of Hawaii, Dept. of Land and Natural Resources	Corey Adler

VI. Owner's Representatives Present

Maui County, Department of Water	Walter Hager

VII. Summary Report Team

Organization	Name
U.S. Army Corps of Engineers	Derek Chow Bill Empson
State of Hawaii, Dept. of Land and Natural Resources	Denise Manuel Edwin Matsuda

VIII. Dam Type

The dam appeared to be an earthen embankment dam.

IX. Dam Classification

The current hazard classification of this dam is: Undetermined

The classification should be determined.

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Most likely Small but insufficient information is available to inspectors to make a determination.

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

X. Summary of Inspection

Condition Rating Criteria: The conditional terms in this report are used to generally describe the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

Dam ID: MA-0144
Name: Maui County Water

A. General appearance:

The dam consists of an earthfill embankment. The dam is approximately 30 feet tall and 630 feet long. The dam is fed by an irrigation ditch. The purpose of the reservoir is drinking water. The upstream slope and reservoir is lined with an HDPE liner.

Findings and Corrective Actions:

a. An Emergency Action Plan (EAP) is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
b. Access to the site appears to be satisfactory.
c. Emergency Alarms / Monitors: There were no alarms or monitors observed on this reservoir.
d. Power / Communication: There were no communication systems observed on this reservoir.

B. Access / Security:

Access to the dam was accomplished via a private roadway.
A four-wheel drive vehicle is required.

Security issues. Access to the dam is unrestricted.

C. Intake Works:

The reservoir has 2 intakes, a 24" ductile iron pipe and a 6" ductile iron pipe.
The control is by a valve where the flow can either be shut off or bypassed.
The water comes from an irrigation ditch above the reservoir.

Findings and Corrective Actions:

a. The intake works were not tested.
b. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time

D. Reservoir:

The reservoir level was 18.8 feet per gage.
The normal operating level is 11 to 20 feet per gage.
The typical operation of the reservoir is kept within normal range.
There is an electronic staff gage. Reservoir stage read from a computer in the plant's control room.

Findings and Corrective Actions:

a. The reservoir was not inspected.

E. Upstream Slope: (Satisfactory)
The upstream slope was 1 on 3.
The upstream slope was protected with a HDPE liner.
The upstream slope was covered by the liner (HDPE); therefore, cracks and sinkholes were not visible at the time of inspection.
The upstream slope had no vegetation.

Findings and Corrective Actions:
a. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

F. Crest: (Satisfactory)
The dam crest was approximately 15 feet wide.
An unsurfaced road is on the crest.
Short grass covers the crest.

Findings and Corrective Actions:
a. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.

G. Downstream Slope: (Fair)
The downstream slope was approximately 1 on 3.
Access was by lower roadway along toe and roadway to outlet works.
There was no slope protection observed at the time of inspection.
Most of the slope has short grass cover. However, the slope on the north side of the dam (Maui Land and Pineapple Co. property) contains dense brush and small trees and inspection in this area was difficult.

Erosion, cracks and sinkholes were not observed on the south and west sides of the dam (area with short grass cover). Erosion, cracks, and sinkholes were not visible on the north side of the dam due to the dense brush and trees.
There was no seepage observed at the time of inspection.

Findings and Corrective Actions:
a. The downstream slope appeared to be in fair to poor condition and requires corrective action.
b. The downstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
c. Tree(s) were observed along the downstream slope. Trees have been identified as the probable cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2” diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of a licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

d. Corrective action for clearing the dense vegetation is for the section of dam on property maintained by the Maui Land and Pineapple Co.

H. Abutments / Toe: (Fair)

Dense brush and small trees were growing on the property maintained by the Maui Land and Pineapple Co. The dense vegetation made inspection difficult.
Short grass covered the left abutment and most of downstream toe on property maintained by Maui County. Inspection of the left abutment and toe area on property maintained by Maui County was possible.

Findings and Corrective Actions:

a. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
b. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
c. Corrective action only for the toe and right abutment on Maui Land and Pineapple Co. maintained property.

I. Outlet Works: (Satisfactory)

The outlet consists of a 12” diameter steel pipe.
The control of the outlet is with a valve that is on the downstream side.

Findings and Corrective Actions:

a. The outlet works were not tested.
b. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

J. Spillway: (Satisfactory)

This spillway is consisted of a 24” in diameter ductile iron pipe on the right abutment.
The approach was clear.
Erosion was not observed at the time of inspection.

Findings and Corrective Actions:

a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.

K. Down Stream Channel: (Unknown)

There is not downstream channel on this reservoir. The outlet pipe runs to the drinking water treatment.

Findings and Corrective Actions:

a. The downstream channel was not inspected.

XI. Additional Comments:

There is no immediate threat to the safety of the dam.

Recommendation:

1) The vegetation conditions and west and south side of the embankment and toe and the left abutment were excellent. These areas were covered with short grass and are routinely mowed. The dam owner should continue with their current vegetation management practice on the west and south side of the dam.
2) The north side of the dam and right abutment is covered with dense brush and small trees. Visual inspection is difficult. The brush and small trees should be removed and the grass kept short. Mr. Hager informed the inspector that Maui Land and Pineapple Company is responsible for maintaining this segment of the embankment and abutment.

PHOTOGRAPHS

MA-141 Maui County Water West

MA-144 Maui County Water West

144 View of the crest. The upstream slope is to the right. Short grass covers the crest.

MA-144 Maui County Water West

144 Ditch leading from irrigation ditch to the reservoir intake manifold.

MA-144 Maui County Water West

144 Diversion structure at the irrigation ditch upstream of the reservoir.

MA-144 Maui County Water West

144 downstream - View of the downstream slope of the dam. The slope is covered with short grass. The vegetation condition and management of this section of the slope is excellent.

MA-144 Maui County Water West

144 gage - View of the staff gage measuring device on the downstream slope of the dam

MA-144 Maui County Water West

144 intake 1 - View of the reservoir intake manifold. The downstream slope of the dam is in the background.

MA-144 Maui County Water West

144 intake 2 - View of the reservoir intake manifold. The downstream slope of the dam is in the background.

MA-144 Maui County Water West

144 outlet - View of the 12” diameter outlet on the left and a 6” diameter inlet on the right.

MA-144 Maui County Water West

144 reservoir 1 - View of the reservoir. The reservoir is lined with a geomembrane.

MA-144 Maui County Water West

144 reservoir 2 - View of the reservoir. The reservoir is lined with a geomembrane.

MA-144 Maui County Water West

144 slope veg 1 - Dense brush and small trees located on the downstream slope on property that is maintained by Maui Land and Pineapple, LLC. The brush and trees should be removed and the grasses kept short.

MA-144 Maui County Water West

144 slope veg 2 - Dense brush and small trees located on the downstream slope on property that is maintained by Maui Land and Pineapple, LLC. The brush and trees should be removed and the grasses kept short.

MA-144 Maui County Water West

144 View of the spillway intake (24” diameter ductile iron pipe)

MA-144 Maui County Water West

144 view of upstream slope of the dam 1

MA-144 Maui County Water West

144 view of upstream slope of the dam 2

MA-144 Maui County Water West

144 view of upstream slope of the dam 3

MA-144 Maui County Water West

144 view of upstream slope of dam - 4

MA-144 Maui County Water West

144 View of the dense brush and small trees located on the section of dam maintained by Maui Land and Pineapple, LLC (opposite side of fence).

FIELD INSPECTION SHEETS

Dam ID: MA-144
MAUI COUNT WATER WEST

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Inspection No: _____
Date: 4/7/2006

Inspection Type: Dam Safety Inspection

Persons Present	Affiliation	Phone Number
HENRI MULDER	USACE	
JOHN DILLON	USACE	
DIANA PERRY	NRCS	
WALTER HAGER	MAUI COUNTY	
CORET ADLER	DLNR - Forestry	

Weather Condition: ☐ Rain previous day ☐ Rainy ☐ Drizzle / Mist ☐ Cloudy/Overcast ☐ Partly Cloudy ☒ Sunny ☒ Dry

Comments: _____

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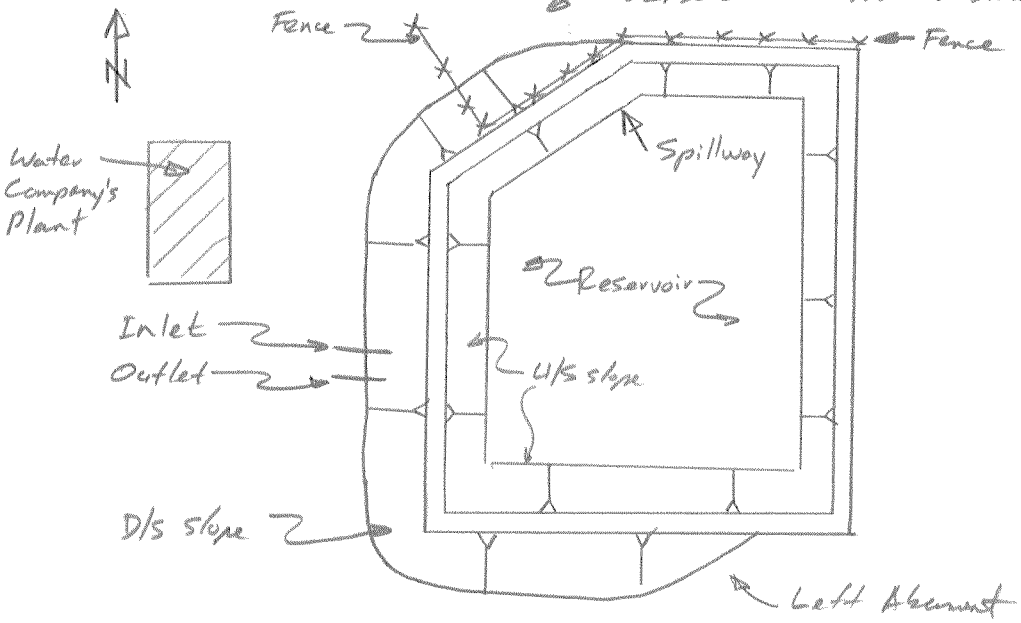
1. General: *(Information currently on file, update as required)*

Dam/Res. Name: MAUI COUNTY WATER
Owner: MAUI COUNTY
Owner Contact: PAUL SELTZ — Owner Ph.: _____
Lessee: _____ — Lessee Ph.: _____
O & M Contractor: _____ — O & M Ph.: _____
Nearest City: KAHANA — Latitude: 20°56'57.2" ° (decimal)
County: MAUI — Longitude: 156°39'28.8" ° (decimal)
Tax Map Key(s): _____

Dam Status	A	Hazard Potential		Dam Size	
Year Completed	1995	Dam Length	630± ft.	Dam Height	30± ft.
Normal Storage	ac.ft.	Max. Storage	61 ac.ft.	Max. Surface Area	6.1 ac.
Offsite Drainage Area	mi.	Spillway Type		Max. Spillway Q	cfs

Owner owns land under dam facility: _____
Emergency Action Plan on file with the Department: _____
Reports on file with the Department:

Right abutment
Area north of fence is maintained by Maui Land & Pine. This section of the dam contains dense underbrush and small trees.



PLAN VIEW OF DAM & RESERVOIR

Dam ID: MA - 144
MAUI COUNTY WATER

Inspection No: _____
Date: 4/7/2006

2. Questions for Owner's Rep.:

	Yes	No	Unknown	Comments
Construction Plans Available	☒	☐	☐	
Site / Facility Map	☒	☐	☐	
Operation & Maintenance Manual	☒	☐	☐	
Emergency Action Plan	☐	☒	☐	
Modifications / Improvements	☐	☒	☐	
Conduct Routine Inspections	☒	☐	☐	
Conduct Routine Maintenance	☒	☐	☐	
Vehicle access to site	☒	☐	☐	☐ Not accessible ☐ With Standard car ☒ Requires 4-Wheel Drive
Access during heavy rains	☒	☐	☐	☐ Not accessible ☐ With Standard car ☒ Requires 4-Wheel Drive
Access when spillway is flowing	☒	☐	☐	☐ Not accessible ☐ With Standard car ☒ Requires 4-Wheel Drive
Other Studies Conducted	☐	☒	☐	☐ Phase I ☐ Phase II ☐ Hydraulics ☐ Stability ☐ Hazard ☐ Seismic ☐ Other: _____
Incident History	☐	☒	☐	☐ Breached ☐ Overtop ☐ Slide ☐ Down stream Flooding ☐ Other: _____
Reservoir's Current Use	☒	☐	☐	☐ Sediment ☐ Irrigation ☐ Recreation ☐ Flood Control ☒ Drinking Water ☐ Power Generation ☐ Other: _____

Findings and Corrective Actions:

- ☐ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☐ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- ☒ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☐ f. Routine inspection logs were not inspected.
- ☐ g. Dam owners shall provide for routine inspection of the dam.
- ☐ h. The dam did not appear to be maintained on a regular basis.
- ☒ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☐ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- ☐ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required	Recommended	
☐	☐	Phase I Study
☐	☐	Phase II Study (Including ☐ Seepage ☐ Hydrology/Hydraulics ☐ EAP)
☐	☐	Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity)
☐	☐	Stability Analysis
☐	☐	Seismic Analysis
☐	☐	Hazard Classification
☐	☐	Other: _____

Dam ID: MA · 144
MAUI COUNTY WATER

Inspection No: _____
Date: 4/7/2006

Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

3. Reservoir:

Level during inspection 18.8' ft per _____ (gage / other)

Normal Operating Level/Range 11 to 20' ft per _____ (gage / other)

Description: _____

Typical Operation ☐ Spillway always flowing ☒ Kept within normal range ☐ Kept Empty ☐ Drained Daily ☐ Only filled by Storms

☐ Other: _____

Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep ☒ Not Visible ☐ None Observed

Description: _____

Staff Gage: Description: Electronic staff gage. Reservoir stage read from computer in the plant's control room

Findings:

☒ a. The reservoir was not inspected.

☐ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ c. The reservoir appeared to be in fair to poor condition and requires corrective action.

☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

☐ e. The staff gage needs maintenance and/or repair. Description: _____

☐ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.

☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.

☐ h. _____

4. Intake Works Description:

☒ Number of Intakes 2 — 24" ductile iron pipe; 6" ductile iron pipe

☐ Intake Culvert / Pipe

Size: 6&24 in. ☒ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control: ☐ Gate ☒ Valve ☒ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☒ Other Irrigation ditch

☐ Ditch / Flume

Dimension: _____ (Size x Depth) Shape _____

Surface: ☐ Dirt ☐ Wood ☐ Concrete ☐ Lined w/ _____

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

Findings:

☐ a. The intake works were not inspected.

☒ b. The intake works were not tested.

☒ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.

☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

☐ f. The intake works needs maintenance and/or repair. Description: _____

☐ g. _____

Dam ID: MA - 144
MAUI COUNTY WATER

Inspection No: _____
Date: 4/7/2006

5. Upstream Slope: (Typical Slope ± 1 : 3)

Slope Protection: ☐ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☒ Liner HDPE ☐ Other: _____
☐ Defect in Protection: Description: _____

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☒ Not Visible ☐ None Observed
Description: Liner covers the slope

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☒ Not Visible ☐ None Observed
Description: Liner covers the slope

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☒ Not Visible ☐ None Observed
Description: Liner covers the slope

Vegetation: ☒ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

☐ a. The upstream slope was not inspected.
☒ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The upstream slope appeared to be in fair to poor condition and requires corrective action.
☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____
☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
☐ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☐ k. _____

Dam ID: MA-1KH
MAUI COUNTY WATER

Inspection No: _____
Date: 4/7/2010

6. Crest: Approximate Crest Width: 15'

Access: ☐ None ☐ Walking Path ☒ Roadway, Surface / Width / Usage: Unsurfaced Road

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed
Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☒ None Observed
Description: _____

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: Short grass covers the crest

Findings:

- ☐ a. The dam crest was not inspected.
- ☒ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The dam crest appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Access along the crest was satisfactory.
- ☐ f. Access along the crest was not possible. Description: _____
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. _____

Dam ID: MA-K14
MAUI COUNTY WATER

Inspection No: _____
Date: 4/7/2006

7. Downstream Slope: (Typical Slope ± 1 : 3)

Access: ☒ lower roadway along toe ☒ roadway to outlet works ☐ walkway to outlet works ☐ None Observed

Slope Protection: ☒ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ Concrete

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☒ Not Visible ☒ None Observed

Description: Inspection difficult on Maui Land & Pine property due to dense vegetation

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☒ Not Visible ☒ None Observed

Description: See above

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☒ Not Visible ☒ None Observed

Description: See above.

Vegetation: ☐ None ☒ Low Ground Cover ☒ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: Most of slope has short grass cover. However the slope on the north side of dam (Maui Land & Pine property) contains dense brush and small trees and inspection was difficult.

Seepage:

Seep Spot Number 1
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed
☐ Flowing, Description: _____
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
Description: _____

Seep Spot Number 2
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed
☐ Flowing, Description: _____
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
Description: _____

Findings:

☐ a. The downstream slope was not inspected.
☐ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
☒ c. The downstream slope appeared to be in fair to poor condition and requires corrective action.
☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____
☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
☒ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
☒ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☐ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.
☐ k. _____

Corrective action only for the slope on Maui Land and Pine property

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8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☒ Not Visible ☒ None Observed
Description: Inspection difficult on Maui Land & Pine property due to dense vegetation

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☒ Not Visible ☒ None Observed
Description: See above

Vegetation: ☐ None ☒ Low Ground Cover ☒ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: Short grass on left abtment and most of D/S toe. Dense brush and small trees on Maui Land & Pine property.

Seepage:
Seep Spot Number 1
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed
☐ Flowing, Description: _____
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
Description: _____

Seep Spot Number 2
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed
☐ Flowing, Description: _____
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
Description: _____

Findings:

- ☐ a. The abutments/toe were not inspected.
- ☐ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☒ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☐ l. _____

Corrective action only for the toe and right abutment on Maui Land & Pine property.

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MAUI COUNTY WATER

Inspection No: _____
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9. Outlet Works:

Culvert / Pipe

Type / Size: 12" ductile iron pipe

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other _____

Pipe: ☒ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control Type: ☐ Gate ☒ Valve ☐ Other _____

Location: ☐ Control on Upstream side ☒ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

☐ a. The outlet works were not inspected.

☒ b. The outlet works were not tested.

☒ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.

☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.

☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ i. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ j. _____

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10. Spillway:

Type: ☐ None ☒ Culvert/Pipe ☐ Channel
Description: 24" ductile iron pipe on the right abutment
Dimension: 24" diameter ft. Invert elevation: _____ ft. per staff gage
Slope Protection: ☒ None ☐ Grass ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Concrete
☐ Defect in Protection: Description: _____
Approach: ☒ Clear ☐ High Veg. ☐ Trees ☐ Other: _____
Erosion: ☐ Scour ☐ Gully ☐ Headcut ☒ Not Observed ☐ Other: _____
Description: _____
Vegetation: ☒ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

☒ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
☐ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ d. Slope protection needs maintenance or repair. Description: _____
☐ e. The spillway approach was blocked. Clear approach.
☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____
☐ g. A headcut was observed downstream of the spillway. Corrective / mitigative action is required to prevent this problem from moving upstream.
☐ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
☐ j. _____

11. Down Stream Channel:

Name: _____
Downstream: ☐ Sump ☐ Open Area ☐ Un-Defined Drainage-way ☐ Defined Drainage-way ☐ Other _____
Items along Stream Bank: ☐ None ☐ Road ☐ Houses ☐ Town ☐ Not Inspected
Description: _____

Findings:

☒ a. The downstream channel was not inspected.
☐ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. _____

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Additional Comments:

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

FINDINGS

Conclusion: There is no immediate threat to the safety of the dam.

Recommendations

1) The vegetation conditions and west and south side of the embankment and toe and the left abutment were excellent. These areas were covered with short grass and is routinely mowed. The dam owner should continue with their current vegetation management practice on the west and south sides of the dam.

2) The north side of dam and right abutment is covered with dense brush and small trees. Visual inspection is difficult. The brush and small trees should be removed and the grass kept short. Mr. Hager informed the inspector that Maui Land and Pine is responsible for maintaining this segment of the embankment and abutment.

Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statures Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.